SCIENTIFIC AMERICAN

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1. Uniting t... and bow portions of the vessel at Montreal. 2. The completed vessel under steam at sea. 3. Progress of separated bow and stern portions of vessel through Lake Ontario. 4. Launching of vessel, bow and stern portions separated.

THE SEPARABLE OCEAN STEAMER MACKINAW, BUILT ON LAKE MICHIGAN.—[See page 405.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 27, 1890.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending December 27, 1890.

Price 10 cents. For sale by all newsdealers.

COMMERCE OF THE GREAT LAKES.

We publish in another column an article upon some features of the rapidly increasing shipbuilding industry on the great lakes. The rapid growth of our new navy has attracted attention to our ship and navy yards on our seaboard, at the expense perhaps of the great industries that are now growing up in the heart of our continent. A new era in the shipbuilding business of this country has been marked by the construction for our coast carrying trade of large steel steamers built upon our inland lakes a thousand miles from the Atlantic. The difficulties in the way of this have been great in the fact that the locks of the Welland Canal cannot accommodate vessels of any considerable length. This obstacle has, however, been overcome, as shown elsewhere in this paper, and the expense of cutting a vessel in two and putting the parts together again upon reaching the open seas is more than counterbalanced by the enormous saving in building vessels in the heart of the coal and iron district of this country. It is high time that our Atlantic shipbuilders awoke to the fact that the shipping yards on the lakes are coming into direct competition with themselves.

The merchant marine of the great lakes is being rapidly metamorphosed and the old-fashioned wooden steamers and sailing vessels are being abandoned for modern steel steamers and that production of the last year which has done so much to change the methods of commerce there—the Macdougall whaleback or "cigar boat."

Probably no better index of the enormous growth of our intra-territorial marine service can be found than at the Sault Ste. Marie Canal (connecting Lakes Superior and Huron), where only a small portion of the commerce on the lakes is compelled to pass, but where the gross tonnage during the past year surpassed that of the gross tonnage through the Suez Canal. Not only is this the case, but the Ste. Marie Canal is closed, owing to the severe winters, during nearly one-third of the year, which is not the case with the Suez Canal. The whole story can be no better told than by the table given below, which is compiled up to the close of the present season:

BUSINESS THROUGH THE CANAL DURING SEASON OF 1889.

Total miles tons	5,940,646,332
Total cost of transportation	$8,634,246 63
Average distance freight was carried	700 4-10 m.
Total registered craft using canal during season	9,136
Total registered tonnage of same	7,221,926
Total estimated value of same	$26,926,200
Average value of same	46,747

Season.	ACTUAL FREIGHT. (Tons of 2,000 lb.) E. Bound.	W. Bound.	Valuation of Freight Tonnage.	Average value per ton.
1881	965,280	445,111	$28,905,612 94	$18 47
1882	1,338,077	691,494	31,238,153 68	15 39
1883	1,277,283	660,822	30,730,663 56	17 53
1884	1,909,200	965,587	51,905,786 61	18 09
1885	2,135,066	1,121,562	53,413,472 13	16 40
1886	3,179,943	1,947,816	69,080,071 95	15 26
1887	3,749,446	1,745,308	79,031,757 78	14 38
1888	3,923,344	2,488,079	82,156,019 97	12 81
1889	5,552,641	1,961,881	85,732,527 15	11 14
1890	6,428,808	2,612,275	103,214,948 70	11 31

NOTE 1.

The west bound freight since June 9, 1881 (the date on which the U. S. government assumed control), is 32 per cent of the total, or very nearly one-half as much as the east bound freight.

The valuation of freight for each year is based on the unit values used in 1890.

NOTE 2.

	Total cost of carrying freight.	Cost of carrying per mile, ton.
1887	$10,075,153	2·3 mills.
1888	7,865,077	1·5 "
1889	8,534,247	1·5 "

NOTE 3.

	Value of American craft.	Value of Canadian craft.	Total value.
1887	$17,684,550	$2,088,400	$19,773,950
1888	20,381,100	1,514,300	21,895,400
1889	25,326,600	1,597,600	26,926,200

NOTE 4.

Proportion of freight tonnage carried by Canadian vessels: 1887—7 per cent; 1888—6 per cent; 1889—4 per cent.

The number of vessels passed through the canal in 1890 was 10,537, including 7,268 steamers, 2,872 sails, and 417 unregistered craft. In 1889, 2,228,707 barrels of flour were carried through the canal; in 1890, 3,239,104 barrels, showing an increase of over one million barrels, or an increase of nearly 50 per cent. The 1890 season showed an increase of over 790,000 lb. of iron over the preceding year, equal to nearly 20 per cent increase.

The present lock was completed in 1881 (for description see SCIENTIFIC AMERICAN, December 19, 1885), but it is now inadequate to the present service. Plans have been matured for increasing the capacity of the canal to a navigable depth of 20 feet and for the construction of an additional lock of more than double the capacity of the old lock. This will be 800 feet long between hollow quoins and 100 feet wide throughout. It will have 21 feet of water on the intra-sills at mean low water and, like the present lock, will overcome the difference of level (about 18 feet) with a single lift. Brig.-Gen. O. M. Poe, who is engineer of the work, estimates that the cost of the new work will be between $4,000,000 and $5,000,000. The sum of $2,150,000 has already been appropriated, and the coffer dam inclosing the site has been built and the excavation of the lock pit is well advanced toward completion. The lowest level of this excavation is 53 feet below the surface of the water in the canal above the coffer dam.

The old lock was in use 228 days during the past season, but on the 31st of July an accident to the northerly emptying valve of the lock caused the interruption of 88 hours in the navigation of the canal. No less than 264 vessels, carrying 248,484 tons of freight, valued at $2,525,550, and 1,362 passengers, were delayed by the accident; these facts give some idea of the importance of commerce on the lakes, and emphasize the fact that the old lock, which a few years ago was considered adequate for many years to come, has already reached the limit of its capacity. Since the steps were first taken toward an enlargement of the lockage capacity, the commerce has quadrupled, and frequent blockages would have taken place at the canal, had it not been for the remarkable increase in the average tonnage of the vessels used in the Lake Superior trade. We shall, in a subsequent issue, publish a further account of the changes that have taken place in the merchant fleet of the lakes.

POSITION OF THE PLANETS IN JANUARY.

VENUS

is morning star. She stands first on the planetary record of the month, for she reaches her maximum brightness during its progress. There are two of these periods of greatest brilliancy, as they are called, one occurring thirty-six days before, and the other thirty-six days after, inferior conjunction.

Venus was in inferior conjunction with the sun on December 3d, passing between the earth and sun at a distance of only 15′ from the sun's southern limb. She then became morning star, and, thirty-six days having passed, reaches her period of greatest brilliancy as morning star on the 8th. Her distance from the sun is then about 40° west, and her phase is like that of the moon when five days old. Our celestial neighbor is charming to behold as she comes looming above the eastern horizon three hours before sunrise, and continues to be visible even in the presence of the great sun himself, to those who keep close track of her course. Her southern declination is unfavorable for northern observers. The moon is in conjunction with Venus on the 7th, at 1 h. 16 m. P. M., being 4° 19′ south. The waning crescent and the radiant morning star make an attractive picture as the distance between them lessens on the morning of the 7th.

The right ascension of Venus on the first is 16 h. 19 m., her declination is 16° 49′ south, her diameter is 46″, and she is in the constellation Ophiuchus.

Venus rises on the 1st at 4 h. 29 m. A. M. On the 31st, she rises at 4 h. 4 m. A. M.

JUPITER

is evening star. This month closes his period of visibility. He shines at its commencement for about three hours in the southeast after sunset, but, at its close, sets an hour after the sun. The moon, a two days' old crescent, is in conjunction with Jupiter on the 13th, at 3 h. 28 m. A. M., being 3° 58′ south. Moon and planet will not be far apart on the evening of the 13th.

The right ascension of Jupiter on the 1st is 21 h. 9 m., his declination is 17° 11′ south, his diameter is 32″.4, and he is in the constellation Capricornus.

Jupiter sets on the 1st at 7 h. 19 m. P. M. On the 31st, he sets at 5 h. 57 m. P. M.

MARS

is evening star. The distance still rapidly increases between him and Jupiter, for while the latter planet remains in Capricornus at the close of the month, the former has traversed Aquarius, and nearly completed his course through Pisces. Mars is so small and so far away that the telescopes will let him rest for the present. The four days' old moon is in conjunction with Mars on the 14th, at 9 h. 36 m. A. M., being 4° 57′ south.

The right ascension of Mars on the 1st is 22 h. 53 m., his declination is 7° 59′ south, his diameter is 6″.2, and he is in the constellation Aquarius.

Mars sets on the 1st at 9 h. 38 m. P. M. On the 31st, he sets at 9 h. 33 m. P. M.

SATURN

is morning star. He rises about 9 o'clock in the middle of the month, and may be readily found southeast of the Sickle, as his course lies through a region where he is brighter than the stars in his vicinity. The moon is in conjunction with Saturn on the 28th, four days after the full, at 4 h. 31 m. A. M., being 3° 15′ north.

The right ascension of Saturn on the 1st is 11 h. 16 m., his declination is 6° 53′ north, his diameter 17″.6, and he is in the constellation Leo.

Saturn rises on the 1st at 10 h. 2 m. P. M. On the 31st, he rises at 7 h. 58 m. P. M.

MERCURY

is evening star until the 13th, and then morning star.

He is in inferior conjunction with the sun on the 13th, at 0 h. 31 m. P. M., passing between the sun and the earth, and appearing on the western side of the sun, to commence his swift career as morning star.

The right ascension of Mercury on the 1st is 20 h. 8 m., his declination is 20° 55′ south, his diameter is 7″.4, and he is in the constellation Capricornus.

Mercury sets on the 1st at 6 h. 3 m. P. M. On the 31st, he rises at 5 h. 43 m. A. M.

URANUS

is morning star. His right ascension on the 1st is 13 h. 56 m., his declination is 11° 17′ south, his diameter is 3″.6, and he is in the constellation Virgo.

Uranus rises on the 1st at 1 h. 45 m. A. M. On the 31st, he rises at 11 h. 50 m. P. M.

NEPTUNE

is evening star. His right ascension on the 1st is 4 h. 11 m., his declination is 19° 25′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 4 h. 33 m. A. M. On the 31st, he sets at 2 h. 33 m. A. M.

Jupiter, Mars, and Neptune are evening stars at the close of the month. Mercury, Venus, Saturn, and Uranus are morning stars.

DATE BOUNDARY LINE.

In a pamphlet issued by Captain J. Freiherr von Benko, of the imperial Austrian navy, attention is called to a geographical error regarding the counting of the date in the Philippine Islands, and found in most of the encyclopedias.

According to the researches of the above gentleman, the date boundary line does not pass the Philippine Islands on the western side, but extends on the eastern side thereof, quite a distance out in the Pacific Ocean, so that in the islands the date is identical with the one in Europe, China and all countries to the east of the Cape of Good Hope.

Prior to the year 1844 this was not the case, and the change was made by the then governor of the islands, Narciso Claveria, with the sanction of the archbishop of the diocese, by a decree dated August 16, 1844, and ordering that the coming 31st of December, 1844, be entirely omitted, so that Wednesday, January 1, 1845, followed Monday, the 30th of December, 1844.

It is well known that the date boundary line separates places (mostly small islands) which have different dates, those to the west of the line counting a day more than those to the east thereof.

The boundary line established itself according to the taking of the islands by the Christians, the date depending, however, on whether they came from the east or west.

The Portuguese and Hollanders traveled around the Cape of Good Hope, and hence came from the west, while the Spaniards sailed from the western coast of America and came from the east, and consequently the islands taken possession of by them had one day in the week or date less than the islands taken possession of by the Portuguese and Hollanders.

The Philippine Islands were taken by the Spaniards coming from the east, and had consequently a different date from the one reckoned in Europe. This date was changed in the year 1844 as above mentioned.

In Alaska a similar change was made at the time the United States bought this territory from Russia.

America, with the exception of Alaska, received its date from the Europeans, that is, from the east, while Alaska received its date from the Russians coming from the west over Siberia and Behring Sea to the western coast of North America.

The region of the date boundary really extends in that spherical lune reaching from pole to pole and lying between two meridians 180° western or eastern latitude from the meridians of Paris and Ferro.

This spherical lune also includes the meridian 180° Greenwich. T. G. H.

HOW TO JUDGE THE QUALITY OF CONDENSED MILK.

The general appearance when poured from a spoon should be glossy; the more glossy, the better. It should be ropy or stringy like very heavy sirup.

The color should be that of cream, but the color varies according to the season of the year in which the milk is condensed, the same as milk not condensed varies in color. Milk is more yellow in summer, when cows are on pasture, than in winter, when they are fed on dry hay.

Thickness varies with age. Thickening by age is natural to condensed milk; rapid thickening only proves that the milk is preserved in the best manner and that it retains in the highest degree the characteristics of milk in its natural state.

Condensed milk which does not thicken by age, or which thickens very slowly, is milk abused in the process of condensing.

Consumers make a great mistake in supposing that the thinnest condensed milk is the best.

The thinnest condensed milk contains the most water, and, of course, less of milk solids or milk nutritives. The thickest condensed milk, if in sound condition, is the most valuable.

There is a degree of thickness, however, that is inconvenient. If condensed milk is so thick that it will not run out when an opened can is inverted, it is troublesome to dissolve. If it is not actually hard, very little stirring in the can will render it sufficiently liquid for convenient use.

Condensing milk, if properly done, does not destroy cream globules, but leaves the constituents of milk unaltered and natural. One method, therefore, of determining the relative quality of different samples of condensed milk is to ascertain the amount of butter that can be made from each.

Covering Pipes and Reservoirs for the Conservation of Heat.

A writer in the *Builder*, in the course of a series of articles on "Hot Water Supply," says there is no branch subject in connection with hot water works deserving so much attention as that which forms the heading to this article. It is no exaggeration to say that very shortly no apparatus for hot water supply will be considered complete or finished if the whole system is not insulated, so to speak, so that almost every particle of heat absorbed by the water in the boiler will be obtainable from the taps, instead of nearly 50 per cent of it being radiated from exposed surfaces and worse than wasted.

There are at this moment hundreds, if not thousands, of hot water systems that, by being carefully covered, would be converted from miserably inefficient to highly satisfactory appliances—this in particular with the tank system, when the tank is so commonly fixed in a cold, draughty roof.

An interesting instance of the success attending the covering of pipes occurred quite recently, in which a residence was fitted with a complete system of hot water supply pipes on a scale sufficiently large for a good boiler in a 5 foot kitchen range, but owing to a delay experienced in obtaining the range in question, another of a smaller size, 3 feet, was fitted up and connected to the chimney and circulating pipes for temporary cooking and hot water supply. It was not supposed that this little range with its boiler would do much in the way of water heating, but to the astonishment of every one it gave a really abundant supply of very hot water in every part of the house as quickly in the morning and altogether as satisfactorily as a larger range would be expected to do.

This desirable result was wholly brought about by the pipes and cylinder being everywhere carefully covered with a sufficient thickness of felt, so that however hot the water was within the pipes, no heat could be felt outside the covering, a sure indication that no heat was being dissipated.

It really does seem opposed to all reasonable and workmanlike principles to allow such abundant opportunity for heat to be thrown away, while labor and fuel is being expended in the kitchen apparently for this object. If a fitter or maker of steam engines and appliances did not attend to the subject of this paper in a thorough and workmanlike manner, he would be considered to have hardly mastered the rudiments of his business. The waste of heat is not always the only ill result experienced, as in many instances the warmed air is very objectionable, and if a hot water pipe is carried alongside a soil pipe, it is possible for a very unpleasant feature to introduce itself. It is a very customary practice for a hot water fitter to carry his pipes up in the casing that is nearly always to be found passing from the bottom to the top of the house, this casing containing all the different pipes of the house, such as the cold service from the main, the cold service down from cistern, the water closet cold water service, and, very commonly, the soil pipe. There is no objection to his making use of this casing if it is large enough to hold a few more pipes, and it is often used of necessity, as to carry pipes openly through well decorated rooms is out of the question; but to carry hot water pipes up this case without felting them is an exceedingly bad practice, as they are not only brought into contact with the very cold surface (they have frequently been found wired on to cold pipes, four or five pipes in a bundle), but the heat radiated causes a draught or current of air to set in, as we find in a chimney.

When a casing contains pipes that radiate heat, that casing, within a few moments after the heat is felt within it, is converted into a flue, as by applying heat to air it can be made to circulate to all intents and purposes like water. Air that is brought in contact with heated surfaces becomes heated and rarefied, and, being thus made lighter than the surrounding air, rises, and cold particles immediately flow in to take its place, they becoming heated and following the first particles, and so on, so that it resolves itself into a stream of warm air flowing out of the upper part of the casing, and cold air flowing in in corresponding volume below. This may be excellent in practice when hot water pipes are used for effecting ventilation; but it is fatal to hot water services which are particularly required to keep the heat within them. In many instances they are cooled at about the same speed as they would be if placed outdoors when a strong wind was blowing.

It may be argued that if the casing is stopped off at its two extremities, the trouble will be obviated; and so it would be if the casing was *perfectly* air tight everywhere, and had no cold pipes within it. But this is never the case. There are always numbers of crevices and apertures which permit of a tolerably free ingress and egress of air.

The best material for covering these pipes and also the reservoirs is hair felt. Hair is a naturally poor conductor of heat, and nothing surpasses it for this purpose, especially as it is so easy of application. This felt, which is readily obtainable in sheets, is usually cut up in strips for pipe work; the strips are wound upon the pipe spirally, being secured here and there with cord or wire, but where spiral winding is impossible, it can be tied on in lengths, which answers equally well, but has not such a good appearance.

The best and most complete arrangement for pipe work, but which entails a little greater expense, is to have the felt wound on spirally in one direction, say from left to right, and well secured with cord; then cover this with good canvas, also wound on, but in the opposite direction, and this secured with wire.

It is most necessary, to secure the best results, to have the felt thick enough. Hair felt is sold in great quantities about three-sixteenths inch thick, but this is not thick enough for good work. If possible, have it half inch thick, and a marked benefit will be had by using even thicker than this, or say two thicknesses of three-eighths inch.

In felting cylinders, it is the best plan to take sufficient sheets of felt, and then sew the edges together to form one sheet large enough to go all around the reservoir. This sheet can then best be secured by bands of hoop iron or brass passed round at top and bottom and around the middle, these bands being tightened up by having a bolt to draw the two ends together. After this circular pieces can be cut for top and bottom, these pieces being sewed on to the top and bottom edges of the large sheet. Tanks can be covered in exactly the same way.

Sometimes it is desired to incase the tank or cylinder with woodwork. This makes by far the neatest job, though more expensive, and it causes a little trouble should it be necessary to open the reservoir under some circumstances. If it is decided to have a casing, it is very important that the space between the woodwork and the reservoir be well filled in with some poor conductor of heat, such as cow hair (plasterers' hair); slag wool, or even dry sawdust answers very well when the casing can be filled from the top. If the casing is not "packed" with something, it would be much better to be without it, as it would have a current of cold air passing up through it the same as explained with the general pipe casing just referred to.

If the hot water service pipes are carried up through the house without entering the general pipe casing mentioned, and it is proposed to incase them for the sake of appearance, this casing must also be packed for the reasons explained; but this is frequently neglected with the worst results, as the casing of pipes is frequently done for appearance sake only, the question of radiation not being considered.

Occasionally it is found practically impossible to carry the pipes up inside the house, in which case it becomes necessary to carry them outside. This is very objectionable, but where it cannot possibly be avoided the objections do not avail, but they must be guarded against. In the first place, the pipes *must* be incased, and the casing ought to be of fair size, so that 1½ inches of packing can be filled in between the woodwork and any of the pipes. The packing must fill the case tightly, and it is imperative that the casing be well and tightly secured to the wall, as, should it get loose, the woodwork and the packing will come away from the pipes and leave them exposed.

When pipes are carried outside, the packing is not only needed to prevent great waste of heat, but there is a danger to be guarded against in cold weather, when the pipes are liable to be frozen and an explosion possibly ensue, as the only outlet for any steam that may be generated in the boiler is at the upper extremity of the expansion pipe, unless a safety valve is provided.

Precautions against Consumption.

In a circular on precautions against consumption, published by the State Board of Health of Pennsylvania, the following advice is given: "The duster, and especially that potent distributor of germs, the feather duster, should never be used in a room habitually occupied by a consumptive. The floor, woodwork, and furniture should be wiped with a damp cloth. The patient's clothing should be kept by itself, and thoroughly boiled when washed. It need hardly be said that the room should be ventilated as thoroughly as is consistent with the maintenance of a proper temperature."

IT is now proposed to deepen the upper part of the Hudson River from the present 12 feet depth to 20 feet. This will make the river deep enough for ocean steamers to go up as far as Albany. It is a much needed improvement. The cost is estimated at about $3,000,000.

A DEVICE FOR DEVELOPING THE LUNGS AND ENLARGING THE CHEST.

Flat-chested, round-shouldered, and weak-lunged people will be interested in a device for promoting deep breathing recently invented by Mr. Chas. Cassat Davis, of Los Angeles, Cal., and called by him the "Spiroplethe."

The need of some stimulus to proper breathing is admitted; and if the means utilized in this invention shall induce full, deep respiration, and the needed oxygenating of the blood, it will prove a welcome addition to our hygienic appliances.

The device is simply a small belt or cord which encircles the chest at the point of its greatest expansion, and a take-up mechanism to which the ends of the belt or cord are attached. The take-up mechanism consists of a coiled spring, adapted to tighten the belt at intervals, and a train of wheels or any other regulating device by means of which the speed of the spring in taking up the belt may be regulated.

In use the belt or cord is adjusted to be comfortably tight about the chest when fully expanded. The spring of the take-up mechanism is coiled tightly by withdrawing or pulling a strap which winds around the barrel inclosing the spring and protrudes from the case of the mechanism. One end of the belt is attached to the case of the mechanism opposite the protruding strap, as is shown in the cut; and the other, having been carried around the chest, is attached to the strap, which, for the purpose of adjustment, is withdrawn to its full length from the case. Upon the exhalation of the breath after the full expansion of the lungs, the chest returns to the size natural to it in ordinary breathing, thus leaving the belt loose. Immediately the take-up mechanism begins to gather in the slack of the belt; it continues to gather the slack, and finally

A DEVICE FOR DEVELOPING THE LUNGS AND ENLARGING THE CHEST.

HERZ'S TRANSOM LIFTER.

to tighten the belt about the chest, until the pressure is uncomfortable to the wearer, and compels him to take another full inspiration, thus lengthening the belt. This lengthening is accomplished by the withdrawal of the strap from the case, which act again coils the spring. The spring, in turn, when the breath is exhaled and the chest resumes its natural size, again begins to gather up the slack of the belt. These processes are continued as long as the device is worn.

The intervals between the contractions of the belt may be from three minutes to half an hour as desired.

The take-up device is about the size of a lady's watch, and is hidden by the vest. The apparatus is entirely unobtrusive except during its intermittent contractions, and may be worn during all ordinary physical occupations.

It is claimed that the use of the device induces full breaths at intervals, and thus naturally strengthens and enlarges the lungs and chest. Its continued use produces the same results as does any exercise which calls the lungs into active play.

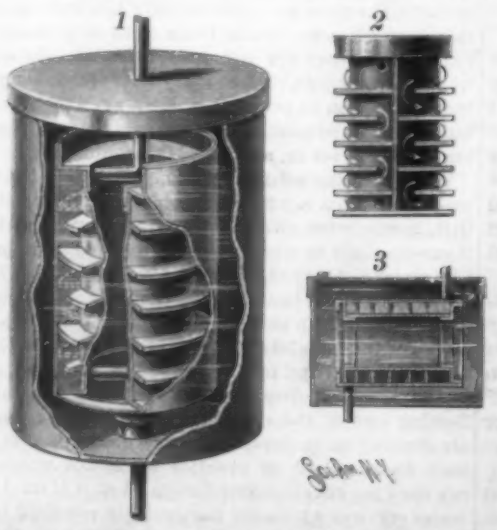
A WINDOW OPENING AND CLOSING DEVICE.

The construction shown in the illustration is devised to limit the outward swinging movement of a transom window, and permit of its being fully or partially opened, while relieving it of all shock or strain. The window is pivoted at its lower edge to the transom bar, and a downwardly and outwardly extending bracket is secured to one side of the window frame, the outer end of the bracket being pivotally connected with a pin on the upper end of a downwardly extending rod. This rod is connected at its lower end with a sleeve on a vertical bar fitted to slide in bearings secured to the casing, one of the bearings having a set screw by which the bar is held in fixed position after the window has been swung to place as desired, and the lower end of the bar having a suitable handle for its convenient manipulation by one standing on the floor. Next to the pin connecting the rod with the bracket is a square offset, engaging the inner end of a spiral spring whose outer end is straight, and rests on a lug projecting from the bracket. Next to this offset is a hexagonal offset on which is fitted a short arm forming a stop, adapted to engage the lug on the bracket, as more plainly shown in the small view, when the window is swung open, thus limiting its outward movement. The angle at which the stop extends can be changed at every thirty degrees, thus regulating the distance to which the window can be opened. When the set screw is disengaged from the bar at the side the spring tends to hold the window closed, but when the bar is drawn down to swing the window open, the spring prevents all shock.

This device has met the approval of and been adopted by the New York Superintendent of Education for use in the public schools, and further information relative thereto can be obtained of the patentee, Mr. Emil Herz, No. 657 East 157th Street, New York City.

A DEVICE TO COOL OR HEAT LIQUIDS.

This temperature regulator has an outer compartment supplied with hot water, or with cold water or ice, according to the temperature it is desired to produce in the liquid to be treated. As represented in Fig. 1, in which parts are broken away to show the interior, a cylinder open at its ends is arranged within the outer compartment, this cylinder being adapted to receive a second flanged cylinder, also shown in Fig. 2, and having longitudinal and segmental transverse partitions, alternate openings connecting the compartments formed by the latter partitions. Fig. 3 represents the construction arranged horizontally. Into one end of the space between the inner cylinders leads an inlet pipe, an outlet pipe extending from the other end, and passing through a suitable packing box. As the liquid to be cooled or heated is passed in by the inlet pipe it traverses the several spaces formed by the partitions between the inner cylinders, as indicated by the arrows in Fig. 2, until it reaches the discharge outlet. The liquid contained in the outer compartment, and surrounding the outer cylinder, also has free contact with the inner surface of the inner cylinder, and the liquid flowing through the space between the cylinders is designed to be cooled or heated to substantially the same temperature as that of the outer



BULCKENS' TEMPERATURE REGULATOR FOR LIQUIDS.

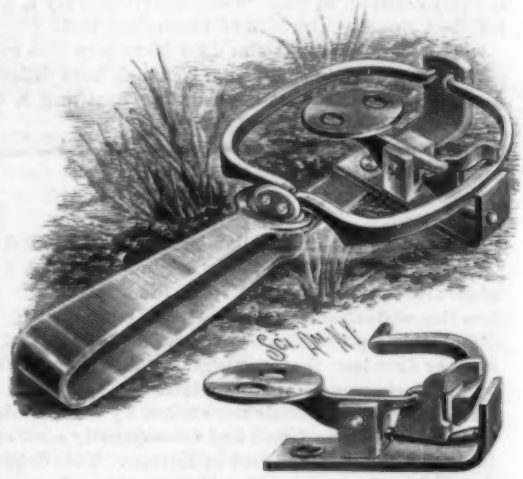
compartment before it passes through the outlet pipe. This regulator has been patented by Mr. Frank V. Bulckens, of Oregon, Ill.

An Immense Cold Storage Plant.

A notable event in connection with the transportation of perishable freight was the laying, on November 13, in Chicago, of the corner stone of the new building of the Chicago Cold Storage Exchange. The building when completed will be the largest in Chicago, exceeding even the Auditorium, and is to be the largest building of its kind in the world. It will consist of two buildings extending the entire length from West Lake Street to West Randolph Street. They will be united by an arcade, under which the railroad tracks will run. The length of each will be 382 feet, the width of the eastern building 70 and the western 85 feet. The dimensions of the West Water Street arcade are 75 by 382 feet, and the cold storage place arcade 36 by 382 feet. Each building will be composed of a basement and ten stories, insulated, piped, and fully equipped, affording three large stores, each 76 feet deep, fronting on Lake Street, and twenty brokers' and commission offices 35 feet deep on the first floor above. The lowest story on the river front will be thrown open, supported by steel columns, thus giving ample facilities for loading or unloading vessels. The total cost of the entire buildings, including the purchase of the business of the Chicago Refrigerating Warehouse Co., will be $1,390,000. The estimated cost on steam plant, elevating and electric service, refrigerating and ice plant is $475,000. In excavating 200,000 cubic yards of earth will have to be removed, and the foundation will require 9,000 piles and 1,250,000 feet of oak timber.—*Railway Review.*

AN IMPROVED TRAP.

A trap which springs easily, which can be set without danger of catching the hands, is self-adjusting, and simple and inexpensive to manufacture, is shown in the accompanying illustration, and has been patented by Mr. James Kemp, of Delhi, N. Y. The jaws of the trap are pivoted in posts at the ends of a base plate, and a spring, consisting of a bar bent into loop shape, has one of its arms fitted on one of the posts under the pivotal point at one end of the jaws, while the other arm of the spring has an aperture adapting it to be pressed down over the post, under the end of the jaws. The spring is thus pressed down, or held under tension, when the jaws are opened out to set the trap, as shown in the main view. A bracket extending at right angles from the base plate carries a post in which is pivoted a lever, as shown in the small view, supporting on one end a plate to which the bait may be attached, while its other end is formed into a catch adapted to engage a pivoted tripping piece, a curved arm of which holds the jaws open when the trap is set. A slight pressure on the bait plate or its lever causes the tripping piece to release the jaws, when the pressure of the spring closes them with considerable force. The jaws may, if preferred, be provided with serrated edges or teeth, but this is not deemed necessary for ordinary service.



KEMP'S ANIMAL AND VERMIN TRAP.

Proper Conduct of Business as a Nuisance.

The fact that a business is carried on in a careful and prudent manner and that nothing is done by those managing it which is not necessarily incident to the proper conduct of the business, will not authorize them to continue carrying on in a populous neighborhood a business which by the noxious character of the odors, fumes, and vapors necessarily incident thereto produces constant physical inconvenience and injury to the persons living in the immediate neighborhood, and if such business is carried on by a corporation, the officers may be convicted personally for maintaining a nuisance.—People *vs.* White Lead Works, Supreme Court of Michigan, 46 N. W. Rep. 735.

PLATE ROLLING AT THE KRUPP WORKS, ESSEN.

The metal from which plates are to be formed is prepared by the Siemens-Martin process; it is cast in rectangular forms, and then, without any preparatory hammering, is taken directly to the rolling mill. Here we find three rollers arranged one above the other. The longest rollers turn out plates nearly three yards wide. There are automatic tables for raising and lowering the plates in their passage from one set of rollers to the other, and automatic devices for guiding them as they pass between the rollers or are taken from them. The man in charge uses a whistle in giving the signals which direct these movements, and without the help of tongs and levers the glowing blocks move back and forth between the rollers. The men standing on both sides of the rollers have only to wipe off the plates with brooms and occasionally turn the plates. The cooled plates have to be straightened and cut according to the size and shape desired. Immense shears with long steel blades cut through these plates as easily as ordinary shears cut through paper. Very thin plates are also rolled here.

Lately a new rolling mill has been put in operation

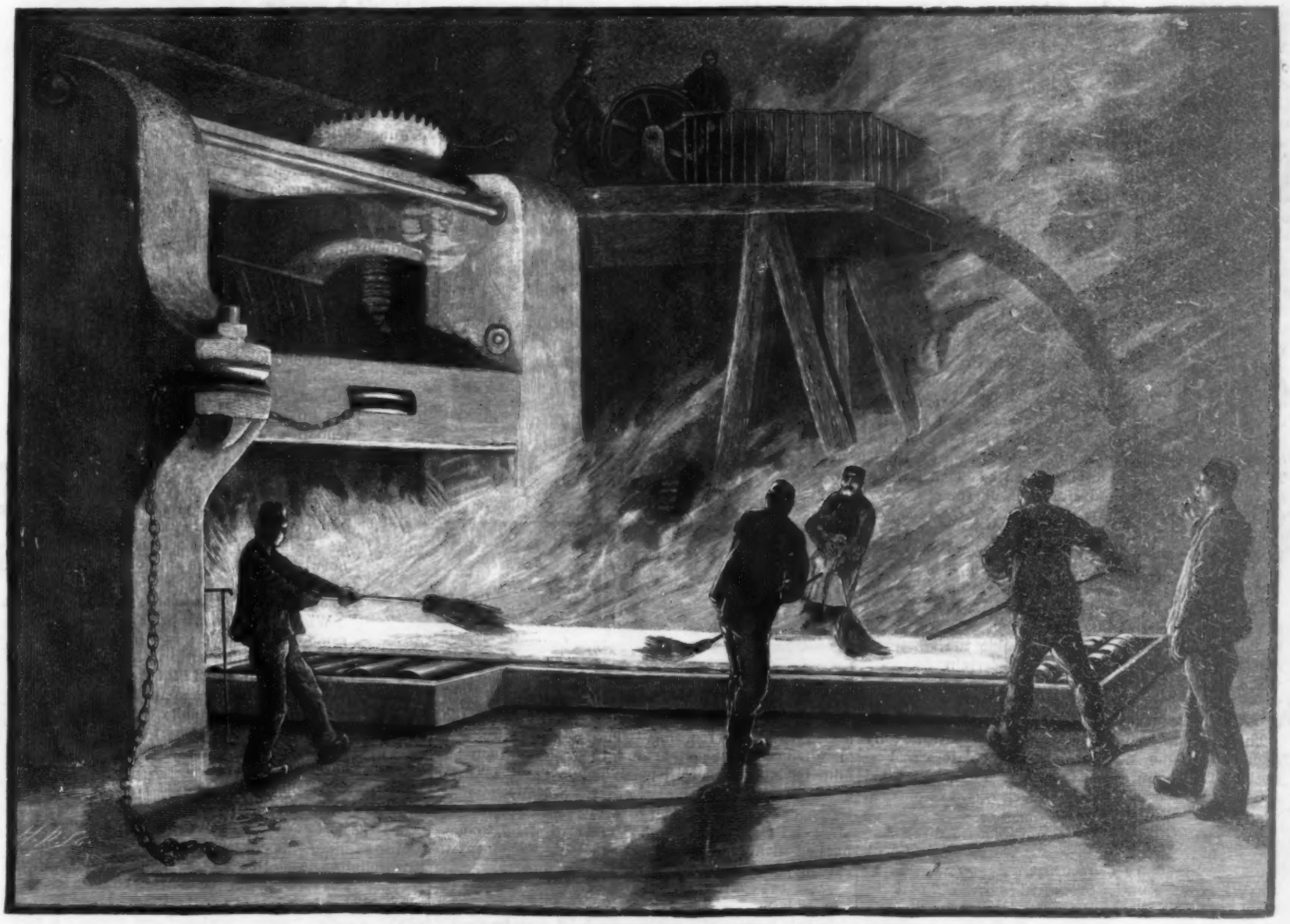


PLATE ROLLING AT THE KRUPP WORKS, ESSEN.

in these works which is much larger than those mentioned and is not, in fact, surpassed by any in the world. It is for rolling armor plates, and turns out the heaviest plates of this description that can be required in any navy, that is, plates about 28 inches thick and nearly four yards wide. Some idea of the dimensions of this machine can be obtained from the statement that each pair of crucible rollers, when in a rough state, weighed 100,000 pounds. The entire rolling mill with its reversing engine, the large furnaces, the cranes, that can move 300,000 pounds, its bending presses, and numerous other machines used in working and adjusting the plates, forms in itself a large plant. These are, of course, only two of the many interesting processes to be found at these works. —*Illustrirte Zeitung.*

Some Ancient Engineering Feats.

The hard mechanical training necessary for an engineer of the present day disinclines him to spend his scanty leisure in studies which cannot be turned to account. The result is that he conscientiously believes his art to be the special flower and glory of the age—in which he is not altogether wrong; but beyond that he regards all earlier feats of engineering as unworthy of serious discussion. And the public, as ignorant, with less excuse, encourage this view.

It is waste of time to ask him how the bowlders of Stonehenge were conveyed to their resting place, how the walls of Fiesole or Mycene were built. These marvels represent the power which lies in the brute force of multitudes, and there's an end of the question. Engineering now is an art and a science, with which the rude work of the savages has no sort of connection. One must not inquire why he takes it for granted that Stonehenge, for example, was built by savages, where the brute multitude came from, how they subsisted on Salisbury Plain, or why it is necessary to assume that they were unacquainted with mechanics.

All that is *chose juges*—beyond dispute. If you cite records of antiquity which tell of works he cannot rival, that fact alone is proof that the record is a lie; for how can it possibly be that mere Greeks and Romans should have been able to do what the builders of the Eiffel Tower and the Forth Bridge cannot accomplish? We had an amusing instance of this feeling lately. The ingenious M. Eiffel and the artistic M. Bartholdi have been gravely pondering the Colossus of Rhodes—measuring and weighing it as per description; and they conclude that the thing was simply impossible.

It could not have been set up, to begin with, and when set up it could not have stood the pressure of the wind. This is demonstrated by all the rules of modern science, and he who does not admit the demonstration must be prepared to show that two and two do not make four. Those antique personages who professed to have seen the Colossus were victims of an ocular delusion or flat story-tellers, and that greater number who mention it incidentally, as we might mention the ruins of the Colosseum, were credulous gossips. The fact is that Messrs. Eiffel and Bartholdi argue in the fashion usual with engineers. Not all of them would pretend that they know every law of nature which applies in such a case. But very few would listen patiently if it were urged that the ancients knew some laws with which they were unacquainted.

So it appears, however, to the disinterested student, and we can bring forward evidence enough. If it be true that the Colossus of Rhodes is really proved "impossible," according to the best modern authorities, this is a good illustration to begin with, for its existence is as well authenticated as the temple at Delphi and the statue of Olympian Zeus, or the Tower of London for that matter, to one who has never seen it. By some means it was set up, and by adaptation of some natural laws it was made to stand until an earthquake overthrew it. One is embarrassed by the number and variety of illustrations to the same effect which crowd upon the mind. Since the Colosseum has been mentioned, we may choose examples of this class. Is M. Eiffel prepared to put an awning over Trafalgar Square when the sun shines, and remove it promptly without the aid of a central support or steam engines, or even chains? The arch of the Colosseum is certainly not less. This may seem a trifling matter to the thoughtless, because they have never considered it. Roman engineers covered in that vast expanse with some woolen material, and they worked the ponderous sheet so easily and smoothly that it was drawn and withdrawn as the sky changed. The bulk of it must have weighed hundreds of tons, all depending by ropes from the circumference. But the ancients thought so little of this feat that they have left us only one trivial detail of the method.

So Julius Cæsar stretched an awning above the Forum Romanum and a great part of the Via Sacra in the space of a single night. Have any of our modern engineers pondered the contemporary descriptions of Alexander's dubar tent before Babylon? That, again, appears to have had no central support. It was upheld, says Phylarcus, by eight pillars of solid gold. Of the glorious plenishing within we have not to speak, since our theme is mechanics. Around the throne and the great courtiers stood 500 Macedonian guards; in a circle beyond them 500 Persian guards; beyond these again 1,000 archers. To fix a tent which held 2,000 soldiers on duty, with arms and accouterments, surrounding, in successive circles, the most gorgeous Oriental court that ever was, with hundreds of satraps, councilors, generals, eunuchs, and slaves, would perplex a mechanician of the nineteenth century. He will reply that the story is false—must be because he could not match it. Happily the awning of the Colosseum stands beyond dispute, and Alexander's tent is a small matter compared with that.—*St. James's Gazette.*

Law Regarding Contributory Negligence.

In an action to recover damages sustained by reason of negligence of another, where it appears that the one injured did not exercise himself the degree of care due from him, it is a correct statement of the law in the case that where both are guilty of negligence the injured one cannot recover, and that the law will not stop to measure the degree of negligence on the part of the complainant. The question is not as to which one is most negligent, or as to which is most responsible for the accident. If the one injured was negligent at all, he cannot recover.—Milford *vs.* Long, Supreme Court of Pennsylvania, 20 At. Rep., 425.

Overhead and Track Wiring for Electric Railways.

BY W. H. CULL, IN THE ELECTRICAL ENGINEER.

It has been said that constant vigilance and absolute cleanliness are the two requisite elements to the successful operation of electrical apparatus. It is certainly true when applied to an electric railway. Too much attention cannot be given to the overhead construction and track wiring. Iron poles are probably the most desirable for many reasons, and should be set at intervals of 125 feet, 6 feet deep, in a rich bed of concrete, surrounding the pole from 12 to 15 inches, and should be of sufficient strength to show a deflection of not more than 4½ inches at the top of the pole when put under a direct strain of 800 pounds, and to stand a strain of 2,000 pounds without bending them beyond their elastic limit. The top should be provided with a device admitting of the most perfect insulation for the suspension wires, and if guard wires are to be put up, with an extension for the guard suspension wires at least 10 inches above the trolley suspension wire. The trolley wire should not be smaller than No. 0 hard-drawn copper wire, supported by suspension wires of galvanized steel wire of a size not smaller than No. 5 American gauge; the hangers, or ear bodies, should be of sufficient strength to stand any sudden strain without breaking and still be as light as possible. The hangers should be provided with an insulation capable of eliminating moisture. From recent tests made we have found that mica or glass gives the best satisfaction. It is well to imagine that no insulation is good enough when insulation is desired. Utmost care should be taken in wiring curves. Instead of building a trolley wire directly over the center of the track, it should be placed directly over a point to be determined by the radius of the curve between the center of the track and the outside rail, and should be as high as the tension on the trolley pole will permit. If a speed exceeding three miles an hour is prohibited on curves constructed in this manner, the trolley wheel will rarely, if ever, run off. Trolley wires put up in sections are absolutely indispensable to the good working of an electric railway. The trolley wires should be divided in sections of sufficient numbers to permit of trouble on the line being located easily and rapidly, and also to enable a large portion of the road to be operated while the disabled portion is being repaired. The frequency of these divisions must depend largely on the peculiarities and situation of the different roads.

On roads where it is practicable, an independent and separate feeder wire connected to each section of trolley wire and provided with a circuit switch at the power station would give a road a most complete system of sectional trolley wiring. In the event of trouble being noticed, it would enable the attendant at the power house to ascertain what section the trouble was on in two or three minutes, and also to keep the uninterrupted portion of the road in operation.

The entire line should be constantly patrolled by linemen trimming trees, examining insulators, and especially curve wiring. All insulators should be treated to a coat of some insulating paint as often as once in three weeks.

Track wiring and ground connections are the most important factors in the operation of an electric road. The supplementary or return wire ought not to be smaller than No. 0 wire connected to each rail twice by a wire not smaller than No. 6. All joints should be well soldered and wiped as plumbers join a lead pipe. In selecting a device to connect the bond wires with the rail, care should be taken to get the one having the least number of connections and making the most perfect contact. The fewer the electrical connections and the better the electrical contact, the more perfect will be the electrical efficiency of the plant.

In Albany we have a most extensive system of track wiring and track ground connections, with which, together with metallic stringers under some of our rails, we have succeeded in getting a return circuit of so low a resistance that our current does not leak to telephone circuits, and consequently does not interfere with telephone service. We have placed copper ground plates, having a surface about 36 square feet, at intervals of 1,000 feet and of sufficient depth to insure their being in permanent moisture.

The Albany railway, with a few exceptions, have carried out the suggestions set forth in this paper, and as a result they are enabled to take their cars up the heavy grades of their three lines, developing an average of only nine indicated electrical horse power per car.

Perhaps the best proof that we have secured a good ground connection, and that we are receiving benefits therefrom, is the fact that we require no metallic connection in the return circuit between our power station and that portion of road now operated by electricity, a distance of about one mile.

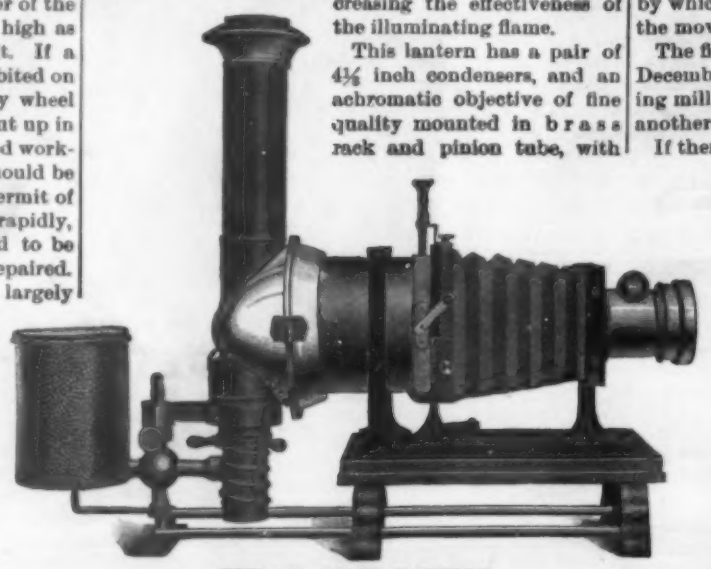
When the road was first equipped by the Thomson-Houston Company no ground connection was made, but two No. 0 American gauge copper wires were strung overhead over this section for the purpose of carrying the current back to the generator. Tests made by us after we had connected our ground connection to the supplementary wire and track proved that we were deriving no benefit from these overhead return wires. We, therefore, abandoned one of them, and intend to make a feeder wire of the other.

The writer recommends perfect ground connections with the track and supplementary wire, and believes that it should be the aim of electricians to return the current to the generator in a path as direct and having as little resistance as possible. By the lower resistance encountered in the return portion, the total resistance to the currrent is very materially reduced, and economy of power and efficiency of service in motors are gained.

IMPROVED OIL LIGHT LANTERN.

The optical lantern as a means of instruction and amusement, and as an advertising medium, is becoming more and more popular as the lantern is improved in quality and rendered more manageable. One of the objects sought by makers and users of lanterns is an inexpensive, safe and efficient means of illumination; something always ready and capable of being used anywhere.

The lantern shown in the annexed engraving seems to have these qualities, besides being optically and mechanically complete. It is not presented as the equal of the electric or oxyhydrogen lantern, but great superiority is claimed for the oil light used in this lantern. The manufacturers have named it the Parabolon Oil Light Lantern, on account of the peculiar construction of the lamp, which permits of the use of a highly polished parabolic reflector, thus greatly increasing the effectiveness of the illuminating flame.



NEW OIL LIGHT LANTERN.

This lantern has a pair of 4½ inch condensers, and an achromatic objective of fine quality mounted in brass rack and pinion tube, with milled head for focusing. The objective tube is mounted on a cast metal stand, the foot of which has milled edges to run in machine-grooved tracks for extra focusing. At the back of the objective stand is fastened the small end of a bellows hood, having its large end fastened to another movable stand, in connection with which is a lever-actuating movement to extend the bellows evenly back, and, if necessary, close against the front condenser, thus preventing the escape of light.

In this lantern the oxyhydrogen jet may be used if desirable. The slide holder is arranged for the introduction of slides or negatives of any size, vertically or horizontally.

Messrs. J. B. Colt & Co., 16 Beekman Street, New York City, are the manufacturers, and will furnish additional particulars to any interested.

The Roller Mill Decision.

The United States Circuit Court, Northern District of Illinois, rendered a decision not long ago on the famous roller mill case which is of interest to millers, and if sustained by the Supreme Court, will be of much importance.

The process of grinding grain by means of rollers as a substitute for the immemorial millstones originated in Europe, and the devices therefor had been brought to an approximately successful operation long before they were adopted in the United States.

But as soon as their use began here, certain parties undertook to gain the practical control of all roller mills by obtaining patents for roller-adjusting devices, and then seeking to obtain, through the courts, very broad interpretations of their patent claims. In using the rollers it is essential that adjusting devices for them shall be employed. The patentee who controls the adjustments practically controls the use of the rollers, and would thus be enabled to levy a private tax upon nearly all the flour produced in the country. But this ambitious project, although hitherto sustained, has been defeated by the decision of Judge Blodgett, who holds as follows in the case of the Consolidated Roller Mill Company *vs.* Barnard & Leas Manufacturing Company:

The fourth, fifth, and sixth claims of letters patent No. 222,895, granted December 23, 1879, to William D. Gray, for an improvement in roller grinding mills, declared void, substantially all the devices thereof being found in the Nemelka Austrian patent and the Nemelka French patent of 1875, and the Nemelka-Lake English patent of 1877.

The second and third claims of letters patent No. 238,677, granted March 8, 1881, to William D. Gray, for a roller mill for grinding grain, declared void, substantially the devices thereof being found in the Nemelka French patent of 1875.

Gray held to have merely adoped well known equivalents for the mechanism known and shown in the prior art for producing the same adjustments which are secured by his machine and operating in substantially the same way.

Gray not considered an original inventor and entitled to invoke the doctrine of equivalents in regard to his mechanism in any respect, he having come into the art at so late a date, and when others had covered the same ground which he attempted to cover; his patents therefore to be sustained, if at all, only for the special devices which he shows, in which case the defendant is held not to infringe, his devices being substantially different from those of Gray.

The second claim of reissued patent No. 10,130, granted June 20, 1882, to W. H. Odell, for a roller mill, declared void for want of patentable novelty, in that it did not require invention to connect the shaft by which the cams in one movable roll were operated simultaneously with the cams of the other movable roll in a double mill, in view of the ordinary and well known device by which all the bolts in an iron safe door are shot by the movement of a single lever.

The first claim of letters patent No. 269,623, granted December 26, 1882, to Hans Birkholz, for a roller grinding mill, declared void, the device thereof being only another form of the patent to Gray, No. 222,895.

If there were room for doubt whether there was any patentable difference in the device of Gray and of Birkholz, *Held* that defendant did not infringe said Birkholz patent, the defendant's devices being substantially different.

The court not able to arrive at the conclusion reached in the case of the Consolidated Roller Mill Company *vs.* Coombs (48 O. G., 255), from the eastern district of Michigan, sustaining the patent to Gray, No. 222,895, notwithstanding the rule of comity, which should prevail between the Federal courts in cases involving the same patents.

Where there was a prior decision in the same circuit as that in which the present case was pending against the complainant, pressing with equal binding force as the decision relied upon from another circuit, *Held* that the rule of comity ought not to be invoked to the same extent as in most cases where it has been applied.

Smokeless Powder.

The basis of all the new kinds of smokeless gunpowder is cotton subjected to the action of nitric acid and the consequent formation of mono-, bi-, and trinitrocellulose according to the strength of acid employed. The solubility of the bi-nitrocellulose in nitroglycerine has been already utilized for the manufacture of the so-called "sprenggelatine," but recently a powder of similar constitution has been prepared in Krupp's iron factory at Essen (*Pharm. Zeit.*, Oct. 11, p. 638). The "collodium wool" is saturated with nitroglycerine in a vacuum at 6–8° C., and the excess of the latter then pressed out, so that a product containing about equal parts of nitrocellulose and nitroglycerine is obtained. This is warmed to 60–90° in order to render it gelatinous, 1 to 2 per cent of diphenylamine added to insure chemical stability, and the mass pressed between warm plates, whose surfaces are furrowed according to the degree of fineness required for the powder. This new powder is said to be on the average three times as powerful as the old, the decomposition upon explosion being so complete that only the gaseous products carbon monoxide, carbonic dioxide, steam, and free nitrogen result. In consequence no further vapor appears than a slight puff of steam. The powder, which may be represented by the formula $10C_3H_5(ONO_2)_3+9C_6H_7O_2OH(ONO_2)_2$, also possesses the advantage of not sustaining damage by damp.

Hyaline.

A "horny, translucent, plastic composition of great tensile strength and considerable elasticity, which may be used as a cheap and inodorous substitute for celluloid, and can be worked, dyed, pressed, denitrated, and rendered incombustible or fireproof." "Hyaline" is a mixture of about equal parts of gun-cotton and colophony, or shellac, copal, dammar, turpentine, or of any mixture of these resins.—*F. Eckstein, Plastic Compositions.*

A SEPARABLE OCEAN STEAMER BUILT ON LAKE MICHIGAN.

The decided novelty in shipbuilding which forms the subject of our first page illustration affords one of many recent evidences of the enterprise, versatility of resource, and marvelous energy with which the dwellers along our Northern lakes are making use of the facilities of their wonderfully favored location. The population throughout the great country tributary to these vast island seas has now become so considerable, and so magnificent the wealth of products to be transported, from the field, the forest, the mine, and the workshop, that one does not readily credit the figures showing the actual present magnitude of the business, while it is far more difficult to make a reasonable estimate of the full possibilities of its future growth.

Besides the business of strictly inland commerce, such as involves only intercommunication between the populations living in and near the great lakes, there has long been a reaching out from these centers of Western growth for more effective and direct intercourse with the world at large, as reached from the seaboard, than is afforded by the present systems of canals and railroads. But the impediments to navigation between the lower end of Lake Erie and the ocean have been grave obstacles, notwithstanding the money expended by the Canadian government to make ship navigation possible for vessels of light draught. The six hundred feet descent to tidewater, through short canals and the rapids in many portions of the St. Lawrence, a river which is partially ice-bound every season, has been as yet but very unsatisfactorily accomplished by vessels suitable for profitable ocean service.

A method of reaching and competing with the business of the sea coast and of the world in shipbuilding, an industry which would seem to present insuperable obstacles under the circumstances, has, however, been found on the shores of Lake Michigan. About a year ago a contract was entered into between the Saginaw Steel Steamship Company and F. W. Wheeler & Co., of West Bay City, Mich., for two steel steamships, suitable for service on the Atlantic or in any part of the world, and our illustrations show how one of these vessels, the Mackinaw, was built and launched, with the stern and bow portions separable from each other, so that the vessel could be readily taken apart before entering the Welland Canal, connecting Lake Ontario and Lake Erie, at Port Colborne, and put together again at Montreal, whence she steamed by way of the Gulf of St. Lawrence and the ocean to New York City.

The Mackinaw is of 3,578 gross registered tonnage, 290 feet long, 41½ feet beam, and 26 feet moulded depth. The second vessel contracted for at the same time, the Keweenaw, is a sister ship in all details. They are built of steel from keel to truck, and are double-bottomed water ballast vessels, designed to class A1 twenty years with the American Shipmasters' Association, besides being made extra strong to carry dead weight cargo in any part of the world. They have triple expansion, surface condensing engines, with corrugated furnaces and two steel boilers each, adapted to carry a steam pressure of 160 pounds. Each has steel pole masts, steam windlass, four double steam hoisters, steam steering gear, steam reversing gear, etc., and they are said to be the first American vessels built with steel forecastles above deck, steel midship house, and steel full poop, after the fashion of the considerable class of English freight steamers styled "tramps."

The Mackinaw left the yard of her builders last October and proceeded to Buffalo under her own steam, making twelve knots an hour. Here she was placed in the Union Dry Dock, and a row of rivets was cut out all around her amidships, following along seams and butts with the necessary irregularity consequent upon a proper breaking of butts as called for by the classification rules. A strong amidships bulkhead forward of the fireroom rendered the after section watertight, and, while the vessel was building, a temporary steel "partial bulkhead" had been fitted in the after part part of the forward section, clear of all broken butts. To make the forward body tight it was calked and stiffened with shores about this temporary bulkhead, and the forward section rested upon greased launching ways. Tackle being fitted to this section, and power applied, the two parts were made to slide apart with the greatest ease as soon as the last rivet was cut out. This work was conducted under the superintendence of Mr. Williams, of F. W. Wheeler & Co.

When water had been let into the dock, it was found that the after section, without any ballast, balanced itself beautifully, drawing 9 feet 4 inches at one end and 9 feet 3 inches at the other end. The forward section, not having any machinery in it, required 100 tons of ballast at its after end, and floated at 6 feet 6 inches forward and 8 feet 6 inches aft. The ends of the plates where divided were protected with 3 inches of oak, and the two sections were thus started on their travels through the Welland Canal and down Lake Ontario, as shown in one of the views. The after section, containing the machinery, had steam in one boiler, and backed at the rate of seventy revolutions per minute, steaming stern first, as if this was the proper way to go, while the forward section followed in charge of two tugs. Thus Lake Ontario was traversed and forty-three canal locks passed, besides several series of rapids, before Montreal was reached, the trip occupying about eleven days. At the latter city the two sections were placed on greased ways in Tate's dry dock, one of the views being a photograph showing the vessel in this position, and when the parts were closed in upon each other, the butts came together so closely that a knife blade could not be inserted between the plates. The reriveting was accomplished with facility in the usual way, and the vessel was floated out of the dock a complete hull, defying the eye of any expert to tell where the severance had been made.

It is said that Mr. Wheeler is figuring with several other steamship companies engaged in the coasting trade for the building of similar ocean steamships, besides contracting with the Saginaw Steel Steamship Company for two more vessels to be duplicates of the one described. The officers of the latter company are Hon. Arthur Hill, President; Samuel Holmes, Vice-President; and James Jerome, Secretary and Treasurer. The vessels are to be run in the coasting coal trade.

There has been a great increase in shipbuilding at lake ports for the past three years. In the fiscal year ending July 1, 1887, there were built on the lakes, according to the government reports, 153 vessels, with a total tonnage of 56,488, or about twice that built for each of the four preceding years. In 1888 the activity in this line was still more marked, there being 222 vessels built, whose tonnage was 1[illegible] 103; while in 1889 there were 225 vessels built, of 1[illegible],080 aggregate tonnage. This is only 8 tons less for the last two years than the aggregate of the shipbuilding on the entire seaboard of the country, while the average size of the vessels built on the lakes was more than three times that of those built on the seaboard. It is expected that the increase in tonnage built on the lakes the past year will be yet greater by very considerable figures, for one firm alone, the Globe Iron Works Company, of Cleveland, has put afloat ten vessels, with a total tonnage of about 30,000, and the great iron works combination of Chicago, heretofore the principal manufacturer of steel plates and beams for lake vessels, has now gone actively into the business of building steel vessels for the lake trade.

Nearly all the coal shipments are from, and a large proportion of the ore receipts at, the Lake Erie ports of Cleveland, Ashtabula, Fairport, Buffalo, Erie, Sandusky, Toledo, and Lorain, where immense docks have been constructed for the traffic, with large storage capacity, and complete steam-operated handling apparatus.

The grain trade this year has been phenomenally large. It is principally between Chicago, West Superior, Duluth, and Milwaukee at the western, and Buffalo at the eastern terminals of water navigation. On the line of the Northern Pacific and its branches the elevators are all full, and immense piles of grain in bags, covered by temporary sheds, have been waiting weeks for cars in which to load the overflowing product, while the elevators at the eastern end of the line are also all full. The increased wheat yield this year has been largely in eastern Oregon and Washington, but with the crop possibilities now quite in sight, should a uniformly favorable season be experienced throughout the great wheat belt in the Northwest, the quantities which would be offered for transportation would quite dwarf all the facilities which have been provided therefor, on the great lakes as well as on the railroads and canals. On such a solid basis it is difficult to see how shipbuilders on the great lakes can be too sanguine in their calculations for a continued rapid growth of their business, and in the establishment of the necessary plant and the perfecting of all the appliances therefor it is only natural that they should also reach out for opportunities, and try and devise means, by which they may actively compete with the shipbuilders of the seaboard, in which they have already made a beginning by the building of the Mackinaw and Keweenaw.

Cataphoric Medication.

The question of the absorption into the skin of solutions by means of electric currents has been, says Dr. S. Ehrmann, of Vienna, the subject of many experiments with me since Prof. Wagner first started the discussion by his researches on the cataphoresis of cocaine; and I have at last hit on a very simple experiment. Take two similar glass vessels, with zinc electrodes at the bottom, and fill with a very weak solution of methyl blue; and if an individual places one of his hands in each vessel, then when a constant current of 10 to 20 milliamperes is allowed to pass for five or ten minutes, the hand in the anode vessel becomes covered with blue spots, while the other is not marked. The spots appear most on the back of the hand, where the hair and fatty glands are situated. In the palm and round the nails they do not occur.

Correspondence.

Automatic Sheet Feeder Wanted for Printing Presses.

To the Editor of the Scientific American:

It has always seemed to me that there lies a fortune in store for the inventor who devises a successful automatic feeder for all classes of printing presses. Many more intricate operations are performed automatically, and the writer has always maintained that eventually paper would be fed to all presses by mechanical means as successfully as the sheets are now counted automatically by the ingenious counting device universally used on printing presses. HENRI GERARD.

New York, December, 1890.

The Belt Problem.

To the Editor of the Scientific American:

The explanation of my belt problem of October 4, as given in the issue of December 13, seems sound at first glance, but is your correspondent correct? According to the calculation he makes, the outer belt will travel 25 feet per minute faster than the inner one, or about one inch to every revolution of the 12 inch pulley. Practically, there is nothing like this difference in the motion of the two belts; it is merely a *creeping*, which is slow, positive, and almost irresistible. Then this creeping will vary, as we have shown, if the sides of the leather be reversed. For example, if the outside of a belt be unyielding and the inside flexible, its thicknesses must be added to the diameter of the driving pulley to get its travel; that is to say, the belt will travel faster than the surface of the pulley on which it runs. Then, if an unyielding side of another belt lies on this belt and the flexible side outward, we have two surfaces in contact that, theoretically, travel at the same speed, and there is no creeping. Practically, these conditions can only exist in part.

We infer, then, that the so-called creeping is caused by the crimping of one side of a belt and stretching of the other, in certain proportions, just where the belts come in contact with and leave the pulley surfaces.

QUIRK.

Aerial Navigation.

To the Editor of the Scientific American:

Ever since aluminum began to be produced more cheaply, and especially now that it is promised at prices that will compete with iron, I have thought the time was fully come when this metal, in conjunction with electricity, ought to solve the problem of aerial navigation. Will some one of the many skilled mechanics or inventors who read your journal tell us what, if any, is the obstacle in the way of constructing a practical air ship? It seems to me the problem resolves itself into this: To make an engine powerful enough to raise itself and the car containing it into the air and propel it along. There can be no doubt that the screw is the proper means of lifting and propelling an air ship. The storage battery electrical engine, I suppose, will give the most power according to its weight.

Now, the fatal defect has been that the weight of the engine has been greater than the lifting power of the screw which it would set in motion. But supposing all possible parts of the engine and containing car were made of aluminum, would not enough weight be taken off without reducing the power to lift the car into the air and propel it? If experience proves that the weight is still too great for the power, could not a compromise be effected with gas, so that the car should be forced to rise, and yet be easily controlled and rapidly moved in spite of air currents? It does seem to me that this should be practicable with the aid of aluminum, which is some three times lighter than steel, with the same strength.

From my youth up it has been a dream of mine that I should see men traversing the air in safe and commodious cars, from the aerial road cart holding one or two to the mammoth air ship holding a thousand, directing them at pleasure in any direction, setting at defiance all topographical obstructions, such as bad roads, overflowed rivers, pathless forests, and rocky walls. Shall not the 19th century be crowned by the construction of an air ship which shall excel all present methods of traveling in ease, comfort, rapidity, and safety? Yes, safety, for there is no reason why this contrivance should not be the least liable to accident, if properly constructed.

I should be glad to hear from some one who is posted on this interesting subject. JAMES H. ROE.

Riverside, Cal., December, 1890.

E. C. F. suggests that the explanation of the presence of a snake on the top of a barn, as recently described by C. A. in the SCIENTIFIC AMERICAN, may be found in the fact that hawks occasionally capture snakes and fly away with them, and in the combat which occurs in the air the hawk is sometimes compelled to release his grasp and the snake falls, landing upon the barn or whatever may be below the scene of battle.

OPTICAL ILLUSIONS ADAPTED TO THE LANTERN.

BY GEO. M. HOPKINS.

An interesting illusion produced by three coins—preferably silver dollars—consists in placing the pieces in a row and removing the center one from between the others at right angles to the line upon which they were all originally arranged until the distance between

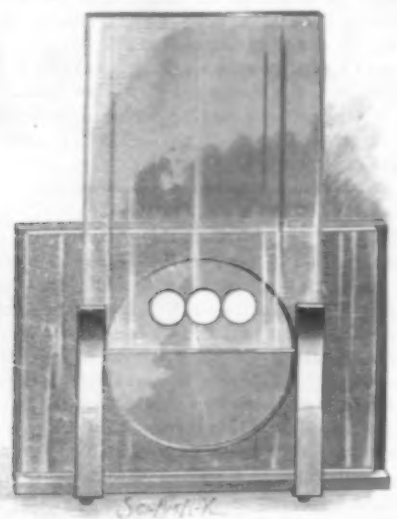


Fig. 1.—OPTICAL EXPERIMENT WITH THREE DISKS.

the moved coin and either of the others is adjudged to be equal to the combined diameters of the three coins, then measuring the distance. It is found almost without exception that the operator fails to move the coin far enough by its own diameter, or more. This simple experiment when shown in the lantern is much more effective than when viewed directly. To adapt it to lantern use, a spring slide holder like that shown in Fig. 1 is fitted to the lantern front, and beneath the springs are placed two plates of thin glass. Upon the inner glass near the upper part of its exposed surface are cemented two disks of paper five-sixteenths inch in diameter and separated a distance equal to the diameter of one of the disks. On the inner surface of the second glass plate is cemented a third disk like the other two. This is attached to the plate near its lower edge, and the plate is arranged so as to bring the three disks in line, as shown in Fig. 1.

By arranging the three disks in a row and projecting them on the screen and taking the distance across the three, at the screen, with a pair of large dividers, the experiment is made ready. Now the central disk is moved down in the lantern (as in Fig. 2), and of course the image moves upwardly on the screen. Let any spectator say when the distance between the moving disk and either of the others is equal to the distance taken by the dividers, then apply the dividers. It will be found that the best eye will be greatly deceived. It is not uncommon to find the best eye measurements wrong by a foot or more.

The probable explanation of this great error in eye measurement is that nearly every one has perhaps almost unconsciously the expectation of seeing the disks arranged on the apexes of an equilateral triangle, so that what he does see in reality is a distance exactly three times as great as is required to fulfill his expectations.

In Fig. 3 is illustrated apparatus for exhibiting in a lantern Professor Thompson's curious illusion of the concentric rings. As is well known, it is necessary to give the rings a gyratory motion like that required in rinsing out a pail, to give the rings the appearance of turning. This is accomplished in the lantern by a movable holder which is suspended on a pendulum bar pivoted to the center of the holder and to the support. The end of the holder which receives the slide is apertured and provided with two curved springs. The opposite end is furnished with a circular hole through which projects an eccentric mounted on a stud projecting from the support. By turning the eccentric by means of the attached handle, the slide is swung around in a circular path and the desired effect is produced on the screen.*

The peculiar whirling effect is thought to be due partly to irradiation and partly to persistence of vision.

* On page 123 of vol. 41, SCIENTIFIC AMERICAN, is given an explanation of the phenomena of these circles.

A MILITARY SUSPENSION BRIDGE.

The necessity of securing good communications for armies on a march has presented itself imperiously in war, in all times, and, among the accessory problems that proceed from it, there is none more difficult to solve than that of the crossing of watercourses.

Whether it is a question of repairing a broken-down bridge or of constructing an entirely new one, it may be said that the activity and science of military engineers at all epochs have been exerted upon this problem, and have given it numerous solutions, but solutions that borrow a character which is in a measure precarious, from the ingenious art itself, and which they require for the utilization of the local resources in each particular case.

There are no universal recipes that permit of acting with certainty and without tentatives. During the war of the rebellion, the Americans, it is true, adopted a system that was quite uniform, and that might strictly be considered as constituting a method, but this system is not capable of being transported everywhere.

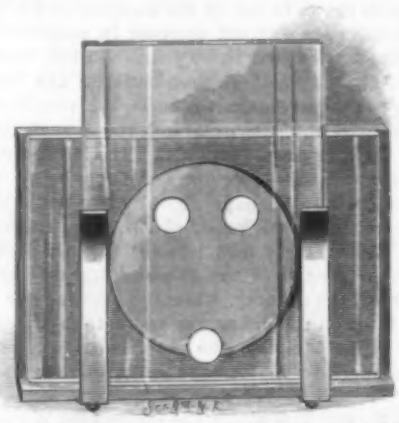


Fig. 2.—CENTRAL DISK REMOVED FROM THE OTHERS THREE TIMES ITS OWN DIAMETER.

It supposes, in fact, the proximity of pretty large supplies of wood for rapidly forming the huge scaffoldings of the high trestles, almost without assemblages, by simple piling. Now this *modus operandi* is perfectly justified in the midst of the great forests of America, but it would be impossible to apply it in our country, when it became a question of crossing quite a wide and somewhat shallow gap. For railway bridges, where the conditions of strength are very imperative, it has been deemed advisable in time of peace to prepare a *materiel* of steel girders in separable parts that will permit of rapidly reconstructing bridges destroyed by the enemy. While, during the war of 1870-71, the repair of a railway bridge always required thirty days, we may rest sure that the *materiel* that we now possess will permit of effecting the same work in less than thirty hours.

Yet it could not be expected that this costly *materiel*, in as large a quantity as we suppose it to be, would suffice to repair the innumerable breaks that an army may meet with upon its route, in its zone of maneuvers.

Roads, especially in mountainous countries, offer a nearly uninterrupted succession of bridges and culverts that the enemy will not fail to blow up. It will be necessary to re-establish these, and it would be impossible to think of satisfying such exigencies with equipments prepared in advance and in sufficient quantity, the carriage of which, at all events, would greatly encumber an army. It will always be necessary to reckon, for a large part, upon the utilization of materials found *in situ*, and what can be done is to pre-

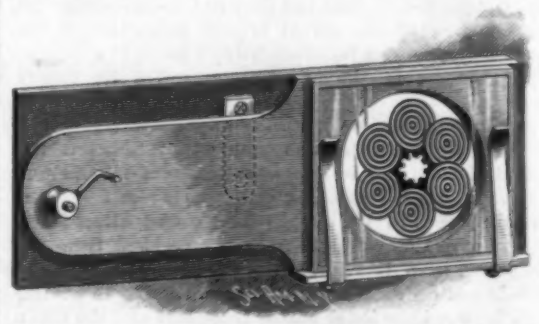


Fig. 3.—PROF. THOMPSON'S OPTICAL ILLUSION ADAPTED TO THE LANTERN.

pare for such utilization by carrying along the accessories which are indispensable and not very cumbersome, and that are capable of greatly abridging the period of performing the work.

The lattice girder of the Howe American system lends itself to the application of this method. The wood that constitutes the heavy and cumbersome part of the construction is found in place in America, and all that has to be done is to carry along the iron work (the diagonal braces and tension rods), the manufacture of which requires special tools and some little time. But, as reduced as we suppose it, the work on the frame of the American truss is considerable, and often exceeds the limits of an improvisation. The idea, then, naturally presents itself of stretching cables over the space to be crossed and of suspending a flooring therefrom. We thus obtain a suspension bridge.

The invention of suspension bridges, in their military applications, does not date from yesterday. If we are to believe ancient history, the bridge that Xerxes threw across the Hellespont was constructed upon this system, which presents two undoubted advantages, viz., saving in material and a lightness that permits of its being applied better than any other to the crossing of wide intervals.

In cable bridges, the parts all work by traction. Now we know that the pieces under tension may be of much smaller section than when they have to work by flexion, or even by compression. A simple comparison will render this consideration more striking. It suffices to cite the example of a rope-dancer walking upon a nearly invisible wire from 20 to 25 feet in length. This wire gets its resistance from the strength of its points of attachment; but we ask what dimensions it would be necessary to give, on the contrary, to a bar of iron of the same length and resting freely upon its two bearing points, in order that it may support the weight of a man. There is no doubt, moreover, that, from a military point of view, suspension bridges present valuable advantages, aside from the relative lightness of the materials of which they are composed, and which render them easily transportable. Owing to the wide spaces that they permit of crossing without the aid of intermediate bearing points, they especially render possible the passage of deep ravines and swift streams. Unfortunately, their advantages are offset by quite a number of defects that can be abated only in a certain measure—the extreme mobility of the bridge, in consequence of the distortions and oscillations which occur under a rolling load, and, besides, the difficulty of forming, upon the two banks, points of attachment strong enough to resist the traction of the cables supporting the floor. Parabolic cable bridges are better adapted for the crossing of wide spaces. In certain military applications, suspension bridges 125 feet in length have been improvised. But, as the initial tensions are feeble, the passage of the least load suf-

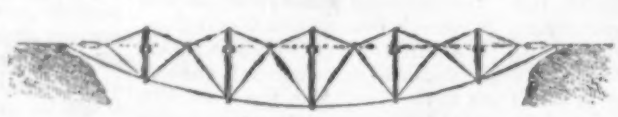


Fig. 2.—PROFILE OF THE BRIDGE.

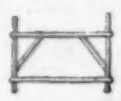


Fig. 3. WOODEN FRAME.

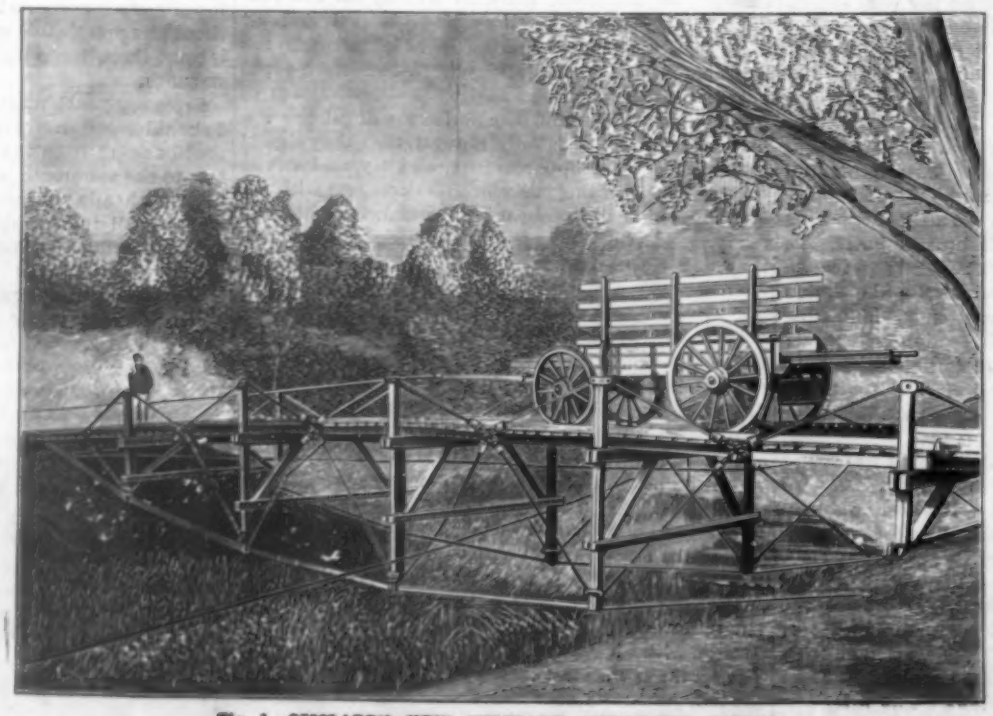
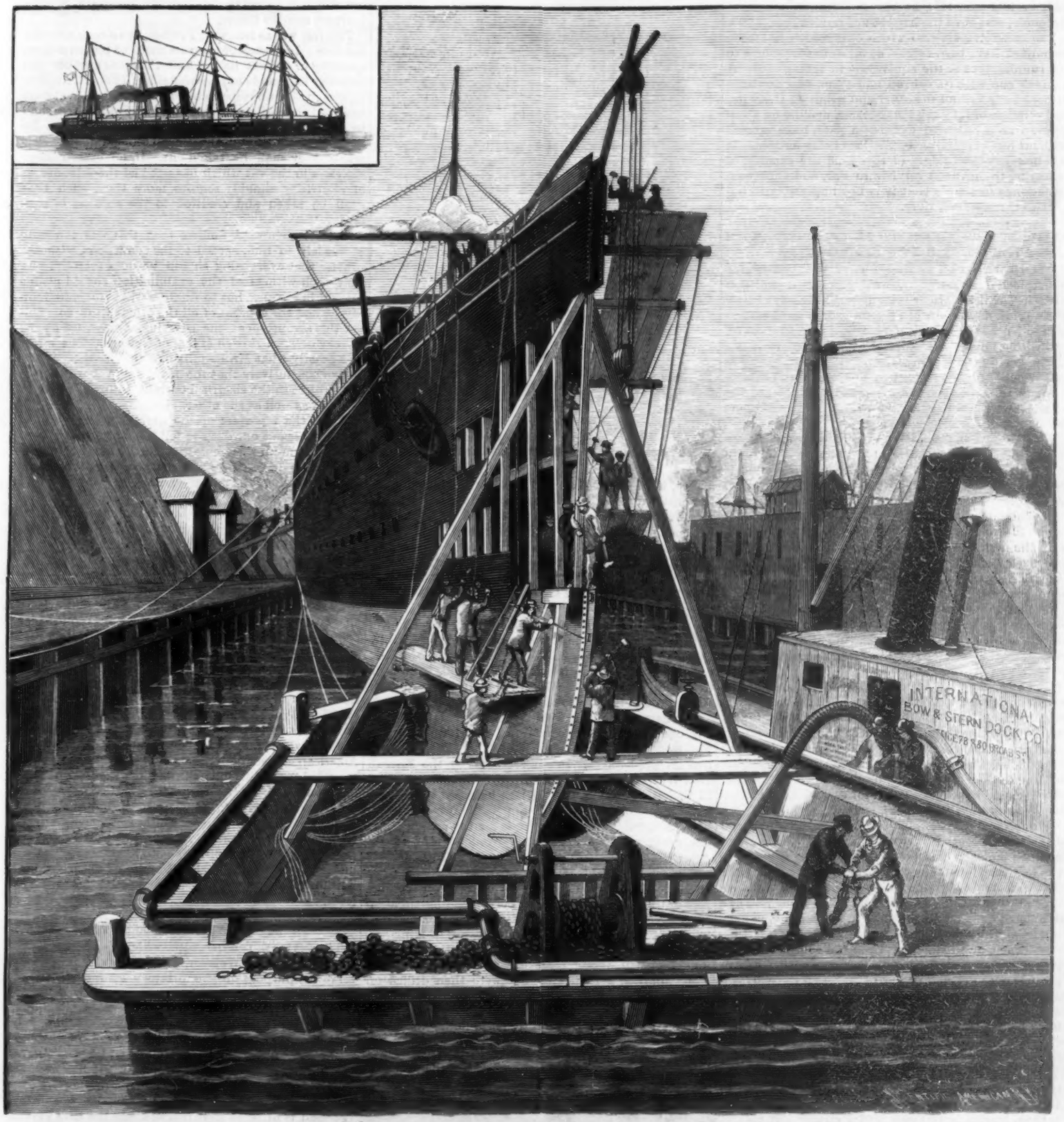


Fig. 1.—OISCLARD'S NEW MILITARY SUSPENSION BRIDGE.

fices to cause important distortions that are shown by oscillations in every direction. In permanent structures we succeed in remedying this extreme mobility by various artifices that it would be impossible to employ in improvised work. The lightness and slight rigidity of the flooring further increase these defects to the point of rendering the passage inconvenient and dangerous. So there is no example of the use of bridges of this sort in war. Those of which a description is given in certain special works have been constructed merely by way of experiment by regiments of pontonniers or by engineer corps.

The only military applications of suspension bridges (the rope bridge made on this occasion having been stretched over a space of 90 feet, and having been capable of giving passage to the entire artillery); the repair of the bridge of Romans over the Isere, effected in 1814 by the French army; and, finally, the rope and boat bridge constructed by the English over the Adour during the same year.

Similar foot bridges are much used in the Cordilleras. The celebrated rope bridge of Chambo was 125 feet in length and 6½ feet in width. A still larger bridge of the same kind connected Quito and Lima. Finally, in the Indies, the length of the Chouka bridge, on chains, was 150 feet.



REPAIRING THE STEAMSHIP LA CHAMPAGNE—APPLICATION OF AN ADJUSTABLE BOW AND STERN DOCK.—[See page 408.]

that we can cite are those of the second class, or bridges upon chains; but then these applications are relatively numerous.

We have already mentioned the crossing of the Hellespont by Xerxes—a fact that carries us back to a respectable antiquity. Let us add to this the bridge thrown by the Swiss over the Po, near Casal, in 1515; the cable bridge thrown over the Clain at the siege of Poitiers in 1569, by Admiral Coligny; the rope bridges that Henri, Prince of Orange, made use of in his enterprises against Gand and Bruges in 1631; those used by the French in Italy in the war of 1742; and, under the empire, the repair of the bridge of Alcantara in Spain, done by Colonel Sturgeon during the campaign of 1810

Although the applications of this type are so numerous, while there exists (at least from a military point of view) none of the parabolic cable type, we must conclude that it is really easier to improvise the first than the second.

Its distortions are infinitely more limited, and, upon the whole, it is easy to obtain the solid attachments that are required by multiplying the number of the anchorage piles on the banks. Its worst drawback is the curve assumed by the flooring laid upon the cables. Wagons move too fast in the descent, and, provided that they are heavily loaded, ascend with the greatest difficulty.

Struck by the inconveniences of the two systems usually employed in suspension bridges, Commander of Engineers Gisclard has endeavored to combine the advantages of both, and, at the same time, to get rid of their inconveniences.

To define the type devised by this officer, and experimented with in 1888 at Grenoble, it may be said that the horizontal flooring rests upon a series of wooden frames spaced 13 feet apart (Figs. 1 and 2). These frames (Fig. 3) are themselves supported beneath by metallic cables forming a parabolic curve.

This arrangement would enter the system of the first type that we examined, but the inventor has succeeded in combining a parabolic support with a strong horizontal traction at the very level of the flooring. The extremities of the uprights serve, in fact, as summits to diagonal metallic cable ties which are connected in fours, at the level of the flooring, with forged iron rings. There is thus formed a series of triangular meshes, which, as a whole, cannot get out of shape. The extreme rings are acted upon by tension blocks that are affixed to each bank at the same points of support as the principal cables. The rigidity of the system is therefore assured by the double traction starting from each of the four points of support.

The putting of such a bridge in place is very easy, requires no special material, and can be performed, without danger, by unskilled men. It consists in first

placing the two principal cables across the ravine, while the entire upper system, composed of uprights and metallic cables, is assembled upon one of the banks. The bases of the uprights are provided with grooved pieces that engage with the principal cables, so that the whole upper part can be made to slide and be led into place by drawing here and there upon the anchorages.

Lastly, the entire affair is tightened by means of pulleys affixed to the last uprights, near the banks, and the flooring is laid according to the usual method.

Trials of this system were made with a 70 foot bridge in 1886 at the proving grounds of Satory, at Versailles, and, in 1887 and 1888, at the fortification moats of Grenoble, and gave the happiest of results.

The successive tests to which this bridge has been submitted have been carried as far as to 460 pounds to the running foot or the equivalent in rolling load. A 4½ inch gun with its caisson and team, two carriages attached one behind the other and weighing 11,000 lb., and columns of infantry four abreast, defiling on a run or even at a cadenced gymnastic pace, have crossed without any perceptible oscillations being noticed. It will be seen that bridges of this kind are capable of rendering the greatest services in war, and their construction is so simple that it is not impossible to improvise them.—*La Nature.*

REPAIRING THE STEAMSHIP LA CHAMPAGNE WITH AN ADJUSTABLE BOW AND STERN DOCK.

The steamship La Champagne, of the Compagnie Generale Transatlantique, was recently in collision with the English steamer Lisbonense in the Bay of New York, off Sandy Hook. In the collision a large section of the stem of the French steamer was broken short off and with a number of plates still adhering to it was carried off by the other steamer. La Champagne was on her outward voyage with a full cargo and passenger list; the other was inward bound. As most of the injuries were above the water line, both steamers reached their docks in safety.

We illustrate the operation of repairing the French ship, while lying at the French line pier 42 N. R., in performing which, a bow and stern dock, as it is termed, the successor to the old-fashioned coffer dam, was employed. The structure is made under patents owned and operated by Henry P. Kirkham & Son, of 78 and 80 Broad Street, New York, and in this instance as in the numerous other ones in which it has been employed, proved of the highest degree of utility. By its use an entire new stem piece and a number of plates were put into the steamer without discharging her cargo. As some of the injuries extended below the water line, and as it was decided to put in a complete stem piece to satisfy the requirements of the insurance inspectors, the forefoot of the steamer had to be exposed.

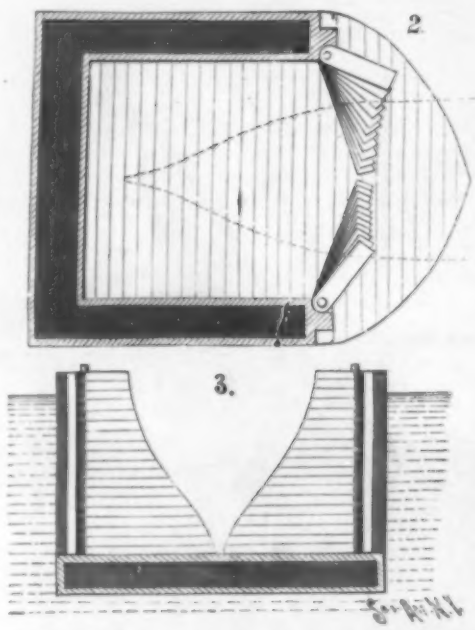
The bow and stern dock is in principle a large box or caisson with water-tight bottom and three water-tight sides. The sides are double so as to form water tanks, which, by proper manipulation of the valves, can be filled or emptied singly. This enables the appliance to be handled with the greatest freedom of action, according to the requirements of the case. The fourth side is closed by a species of leaf doors, whose construction is shown in the diagram.

These doors consist of a series of planks arranged one above the other with their flat sides in contact. All the planks on one side are pivoted by a steel pin passing through their ends exactly as the sticks of a fan are fastened together. There are two sets of planks thus arranged, each set corresponding to one fold of a double door. The planks vary in length, those at the top being the shortest, so that an opening is left between them approximating in shape to the cross section of a ship. Heavy padding covered with canvas extends over the ends of the planks, and the canvas is also caried outside so as to cover their joints as with a sheet. Each plank is three inches thick and twelve inches wide. The caisson used on the steamer in question was 43 feet long over all, 33 feet wide, and 22 feet deep.

In use, it is floated into position off the bow or stern of a steamer, and the doors are swung back to some extent, so as to enlarge the opening. It is then, by means of some cables strung out toward the stern or bow of a ship, as the case may be, drawn back into position. Before being placed beneath the ship, keel blocks may be secured by dogs as in regular dry dock practice if it is deemed necessary. When in position, the doors are swung in against the sides of the ship. The freedom of action of the planks, which is, however, limited to some extent by a slack chain attached to them by ring bolts, enables them to take precisely the shape of the cross section of the vessel, whatever it may be. If necessary they may be driven into place by a tug boat striking them with her bow. When all is solidly secured, the caisson is pumped out to any desired extent. Its flotation may be diminished by leaving the sides full of water. This does away with such bracing as would otherwise be requisite. The water within the body is then pumped down to the level necessary for the workmen, and as much of the ship as desired is exposed.

The floor of the caisson, as will be seen from the plan view, extends well outward, so as to give a base for the doors to work upon. The steel pins on which the doors work have also two or three intermediate connections, by heavy eye bolts, with the caisson.

In the old form of coffer dam the profile of the opening for the admission of the ship had to be specially determined for each case. This was sometimes done by inside measurement of the vessel, in which case the deadwood of a wooden ship or the cement filling of an iron ship often obstructed operations. In one instance, the cement filling of a steamship extended 19 feet upward from the keel, so that no measurement whatever could be taken. Sometimes a beam of wood with a number of holes bored through it, through which bars passed which were free to slide back and forward, was used. It represented a gigantic comb. Lowered over the side of the ship and pressed against its side, the bars would be thrust back, so as to give the points for determining the desired profile. Sometimes a wooden template was made by guess, and the final adjustment of the template was made by a diver. Of course, where the lines of a ship are known, the opening can be made from these. All this trouble is done away with by the leaf doors of the stern dock shown in our illustrations.



PLAN AND ELEVATION OF BOW AND STERN DOCK, WITH LEAF DOORS.

The new stem piece, which was inserted in place of the one broken in the collision, was forged by the Paterson Iron Co., of Paterson, N. J. It is of iron, like its predecessor. It was received by the Morgan Iron Works, of this city, as a straight bar of iron, 4 by 13 inches in section, and 46 feet long, with the front corners rounded off. The first operation was the bending. A special furnace was built for the purpose, and the great mass was gradually brought into shape. After bending, a piece had to be planed off at the base obliquely to give what is known as the "scarf," a species of feather edge, where it lapped over the forefoot of the steamer, which was correspondingly scarfed to receive it. This scarf in the stem was planed out. The bent stem was mounted on the bed of a planer, and the cuts were taken across it at right angles to its axis, each cut, therefore, being only 13 inches long. Four hundred holes in two rows were then drilled for its entire length to receive the rivets by which the plates were attached. The aggregate length of these holes is about 130 feet. It took 72 hours' work, day and night, to shape, drill, and scarf this piece. The old stem broke short off in the collision. It is not believed that the new stem would suffer to anything like the same extent in a similar collision.

The space immediately back of the stem for a few feet is to be filled with a concrete filling. A mixture of hydraulic cement with blocks of wood and other material was removed in the operations of cutting out for the introduction of the new piece. This will be replaced with fresh material.

WEBSTER'S PRINTER'S COMPOSING STICK.

An Experiment in Tanning by Electricity.

A couple of months ago A. Zwierzchowski came from France to introduce the new method of tanning by electricity to the American tanners. We believe he came here with the understanding that at least one firm, a member of which had been in Paris during the summer, would take hold of the invention if it was what it was represented to be. Mr. Zwierzchowski made himself and his errand known to several of the leading producers of leather in New York. He was courteously received and attentively listened to. But he did not succeed in persuading any of the tanners to take shares in his enterprise. They would go no further than to propose the application to the invention of a test which had been proposed by Mr. Jackson S. Schultz fourteen months before.

This test was as follows: "Prepare two circular revolving vats. Into each of the vats shall be placed a given quantity of extract liquor, and the same number and quantity in pounds of prepared sides. In short, the conditions shall in all respects be equal. To the one vat shall be added the electric current and to the other there shall be no electric current. After revolving these vats for a sufficient time to tan the sides accompanied by electricity, they shall be taken out. If, on examination, the sides in the vat which has not had the advantages of electricity should require more time, such time shall be taken and credited to the account of electricity."

Mr. Zwierzchowski, finding that this was the only course left to him, agreed to the conditions, with the proviso that everything should be done secretly, and that each witness of the examination should pledge himself in advance not to disclose what transpired unless he had the consent of all the others to do so. Under this arrangement the experiment was tried at the factory of T. P. Howell & Co., of Newark. The result was exactly what Mr. Schultz had anticipated. It was shown conclusively that the revolving vat which was not subject to the electrical current tanned leather as fast and as well as the other.

When the reporters of the daily papers got on the scent, it became our duty to tell the story exactly as it was. To sum up the whole matter, the vats of the tanners can be propelled by electricity or without it; there is no harm done if it is used, nor any good if it isn't used. We have two specimens of leather before us, one tanned electrically, the other not; the same time was employed on the production of each; the latter is fully as well tanned as the former—if anything, a little better.—*Shoe and Leather Reporter.*

An International Copyright.

The Cincinnati *Enquirer* gives an abbreviated analysis of the international copyright bill which passed the House of Representatives a few days ago, and is likely to pass the Senate without further amendment. The proposition of the bill is to permit foreigners to take American copyright on the same basis as American citizens in three cases: First, when the nation of the foreigner permits copyright to American citizens on substantially the same basis as its own citizens; second, when the nation of the foreigner gives to American citizens copyright privileges similar to those provided for in this bill; third, when the nation of the foreigner is the party to an international agreement providing for reciprocity in copyright, by the terms of which agreement the United States can become a party thereto at its pleasure. A subsidiary but important proposition to the bill is that all books copyrighted under the proposed act shall be printed from type set within the United States or from plates made therefrom.

A DOUBLE TYPE COMPOSING STICK.

The device shown herewith, which has been patented by Mr. James G. Webster, is designed to practically serve the purpose of two printer's composing sticks, and is designed especially to meet the requirements of printers where the variety of work demands quick adaptation, accuracy, and convenience. The side flange of the stick has a longitudinal slot through nearly its whole length, along which travels the thumb screw by which the main set bar or knee is held in place and adjusted as desired for any required measure. The other set bar is shorter, and is fitted to slide in and along the base part of the main knee in a similar manner, being adjusted in the desired position by a separable thumb-screw, the finger-piece of which may be placed on the outside if preferred. Both sides of the main knee are beveled away at the bottom, where it crosses and rests on the broad flat body of the stick where the feet of the type rest. The inside of the other knee, and also the inside of the end piece, are similarly beveled at the base, thus doing away with right-angled seats for the feet of the type, which are not always accurately made, and which are liable to become imperfect when the stick is not well taken care of. These bottom bevels also allow the types to more readily adjust themselves squarely on their feet. For further information relative to this invention address Messrs. Webster & Smith, St. Johns, Province of Quebec, Canada

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Samuel B. and James R. Sadler and David M. Carter, Fairfield, N. C. This is a device in which the latch for holding the coupling pin elevated is movable forward to release the pin, the trigger therefor being arranged for operation by the coupling devices of the meeting car, whereby the cars on coming together will be automatically coupled, while they may be uncoupled from either side or the top of the car.

Electrical.

PRINTING TELEGRAPH.—William W. Taylor, Mansfield, Mass. This invention covers type-writers electrically connected, with a paper supply mounted on and automatically fed from the carriages, a knife to cut off the paper when required, with other novel features, the invention being an improvement on a former patented invention of the same inventor for automatically printing and delivering messages into a public or private receptacle.

HOLDER FOR LAMPS, ETC.—George L. Batchelder, Bloomington, Ill. This is a device for suspending electric lamps and hoods, designed to be readily operated, and so arranged that either or both may be conveniently lowered by a single rope.

Mechanical.

DRESSING AND THREAD CUTTING TOOL.—Samuel T. Harrison, Skipanon, Oregon. This is a combination tool of simple construction designed to be readily applied to a wagon axle to dress it and cut a new thread, or to cut new threads on pipes or bolts, without removing any of the parts from the wagon or article on which they are held.

CAN BODY MAKING MACHINE.—Mathias Jensen, Astoria, Oregon. This is a machine for forming sheet metal can bodies, designed to be simple and durable in construction, not liable to get out of order, and not requiring the attention of a skilled workman, thereby reducing the cost of such work, the invention covering various novel details and combinations of parts.

Agricultural.

PLANTER AND FERTILIZER DISTRIBUTER.—William E. Tucker, Jackson, Ga. This invention relates more particularly to what are known as "walking planters" and "vibrating hoppers," and provides a machine designed to be as well adapted for planting as distributing, and with which the seeding or fertilizing can be done at the same time as the plowing.

CLEVIS AND WRENCH BOLT.—George Evans, Clarksdale, Miss. This is a combination implement, the clevis dispensing with the lap ring and keeping the singletree up higher from the ground, making it less liable for the trace chains to get under the horses' feet in turning, while the wrench bolt is adapted either to secure the clevis to the plow beam or to be used separately as a wrench.

Miscellaneous.

WALKING CANE, ETC. — Ewald Hofel, Lugau, Germany. This is a new article of manufacture consisting of a flexible metallic core having a handle and ferrule, and a covering formed of unbroken conical tubes colored and varnished, the apex of one cone entering the base of the next and being glued therein, there being utilized in the manufacture the discarded paper cop tubes employed in connection with the manufacture of textile fabrics.

NOSE GUARD FOR EYEGLASSES. — William Dengler, New York City. This is a clamping guard attachment with two independent limbs secured by one end of each to the ends of a nose clamping plate, their other ends being held by a binding screw to the lens post, affording a light and strong attachment of the nose guard to the lenses.

WELL SINKING MACHINE.—Henry H. Davenport and Dalton A. Brosius, Vermillion, South Dakota. According to this invention the drill rope or chain carrying the usual drilling tool passes around a pulley held adjustable in a lever to change the drop of the tool, the invention also covering other novel details and combinations of parts in a simple and durable machine designed to be very effective in operation.

TOY GAME.—Julian F. Burd, Dupuyer, Montana. This invention relates to an improvement in toy games of the ball and pocket type, the game to be played with letters or figures and admitting of many variations, the object being to produce a simple and inexpensive device which will combine amusement with instruction.

PUZZLE. — Gavin L. Stairs, Maitland, Nova Scotia, Canada. This is a game or puzzle in which, by tilting and skillfully manipulating a channeled box or case, balls placed therein are made to roll or change their positions till a given goal is reached, there being two pairs of balls used, supposed to represent two opposing parties.

BLACKING OR OILING BRUSH. — Addison Smith, New York City. This is a brush with a vertically swinging lever, with a reversible dauber having bristles on one side and a sponge on the opposite side, and especially adapted for the use of ladies, for applying solid or liquid blacking to shoes, and for oiling or wiping the same, without soiling the hands of the operator.

PROJECTILE.—William Bowman, Atchison, Kansas. Longitudinal side passages are formed in this projectile from its front end to near the rear, where they communicate with transverse passages, the latter intercepting a bore extending forward from the butt, whereby it is intended that the gases from the explosive fired will enter the passages and give the projectile a rotary motion, such as usually obtained by rifling the barrel.

WINDMILL REGULATOR. — John M. Lowe, Butler, Ind. Where windmills are used to fill water tanks, the device provided by this invention is designed to automatically throw the mill into gear when the water is low in the tank, and throw it out of gear when the tank has been filled, this being effected without strain upon either the mill or the pump.

AIR PUMP GOVERNOR. — Craven R. Ord, Montreal, Canada. In a suitable casing is a steam inlet connected by a port with the steam outlet leading to the pump, the steam inlet being connected in the usual manner with the boiler while the port is adapted to be closed by the reduced end of a cylindrical main valve fitted to slide in a cylinder formed on the casing, with a spring and auxiliary valve, and other novel features, the device forming a simple governor for air brakes.

MAKING WOOD AND OIL GAS. — George Ramsdell, New York City. This invention covers an apparatus with a non-combustible and non-porous bottom for the oil retorts, and with feed pipes so leading to the retorts that the pipes will not become choked by the deposition of carbon, while the oil vapors will be released before the hottest portion of the retorts is reached, and the oil not vaporized will be conducted to the hottest surface.

FRUIT PRESS. — Robert Randall, Newark, N. Y. This is a simple and easily worked lever press for operation by hand for pressing dried fruits, meats, etc., when packing them for market, the box or package being readily placed in position to receive the pressure, to be kept on as long as desired, and the press being also adapted for pressing the juices from fresh fruits.

STRUCTURAL RODS. — Wilhelm Lubrecke, Berlin, Germany. This is a tension and compression rod composed of a series of parallel metal plates bent longitudinally at obtuse angles, the rod being adapted to receive joint or pivot bolts at its extremities, whereby structures built therewith may be readily put together and taken to pieces, and the building of bridges will be greatly simplified.

TAPESTRY YARN STEAMING. — James Hutchison, Newark, N. J. Instead of placing the hanks in net frames after leaving the printing drums, and sending them thus to the steaming apparatus, this invention provides a frame with sets of yarn sticks to hold the hanks set vertically in the frame, whereby the yarn is designed to be so supported as to prevent the colors from running into each other.

SEWAGE SLUDGE FERTILZER.—Cresacre G. Moor, Truro, England. This invention provides a process of treating sewage to form a marketable manure therefrom, consisting essentially of phosphates and ammonia, the matters in suspension being precipitated in the form of sludge, while the effluent water is purified and the sludge distilled, carbonized and calcined.

EVAPORATOR. — George H. Brower, Roann, Ind. An evaporating pan divided by several partitions, and with troughs and passageways arranged in connection with the compartments, all arranged after a novel plan over a suitable furnace, thus providing an efficient apparatus for rapidly producing pure sirup from saccharine juices.

CARAMEL TRAY. — Oscar B. Weaver, Williamsport, Pa. This is a device for holding confections for shipping, storing, and exhibiting them for sale, and is composed of a sheet of fibrous material, such as paper, muslin, etc., having intersecting hollow ribs forming rows of shallow, flat-bottomed cells, the whole coated with paraffine.

SHELF SUPPORT. — Otto F. Wegener, Seattle, Washington. This support consists of a main frame and brackets, the latter arranged one above the other and made of strips of metal bent to form horizontal portions, braces, and upright connecting portions, the latter lapped against and secured to the main frame, making a light, neat-looking, and strong device to support a number of shelves.

CANE AND UMBRELLA. — Charles H. Morgan, West Chester, Pa. A hollow tube with detachable ferrule at one end and detachable handle at the other end constitutes the body of the cane and the stick of the umbrella, and the invention covers various novel features, providing a combination article which may be used as cane or umbrella, and which may be quickly and easily changed from one to the other.

SNAP CATCH FOR BAGS. — Daniel M. Read, New York City. A spring-actuated latch having a thumb piece is fitted in a slot in one member of the frame, being fulcrumed at the edge of the slot, while the other member of the frame has a catch to engage the latch, the device forming a cheap and practical lock for reticules, pocket books, etc., adapted to open with the same motion of the hand required in opening the parts of the bag or book to which it is applied.

FINGER LOCK FOR CHATELAINES.—This is another patented device of the same inventor, in which the construction is such that a simple down movement of finger or thumb applied to the lock will operate the catch and at the same time open the bag or book.

MOSQUITO NET FRAME. — Albert C. Lottman, Houston, Texas. This is a simple and durable device formed of suitable uprights, side bars, braces, and connecting bars, designed to be conveniently attached to or detached from a bedstead, and which when in position will be firmly held against lateral movement.

MOSQUITO NET FRAME AND SHAM PILLOW HOLDER.—William Tennison, Mount Vernon, Ind. This is an improvement on a former patented invention of the same inventor, and consists of a cheap and convenient device formed of bent wires, adapted for use for both the purposes named, either together or separately.

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